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Trade-Related Technology Diffusion and the Dynamics of North-South and South-South Integration

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Abstract

This paper examines the impact on total factor productivity of North-South and South-South trade-related research and development (R&D) spillovers. It is the first, as far as we know, to do so at the industry level for developing countries. North-South and South-South R&D flows are constructed based on industry-specific R&D in the North, North-South and South-South trade patterns, and input-output relations in the South. The main findings are:

- North-South and South-South R&D flows have a positive impact on total factor productivity, though the former is larger.
- R&D-intensive industries benefit mainly from North-South R&D flows while low R&D-intensive industries benefit mainly from South-South R&D flows.

These results have implications for dynamic comparative advantage and for the dynamics of North-South and South-South regional integration.

This paper—a product of Trade, Development Research Group—is part of a larger effort in the group to understand the impact of trade on technology diffusion. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Maria Kasilag, room MC3-303, telephone 202-473-9081, fax 202-522-1159, email address mkasilag@worldbank.org. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at mschiff@worldbank.org or molarreaga@worldbank.org. June 2002. (25 pages)

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TRADE-RELATED TECHNOLOGY DIFFUSION AND THE DYNAMICS OF NORTH-SOUTH AND SOUTH-SOUTH INTEGRATION*

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NON-TECHNICAL SUMMARY

Recent theoretical models of economic growth have highlighted the importance of trade as a channel of technology diffusion. Empirical studies of North-South trade-related technology diffusion and its impact on total factor productivity (TFP) have been undertaken at the aggregate level. This paper is, as far as we know, the first to examine North-South—as well as South-South—trade-related technology diffusion at the industry level.

We find that North-South and South-South R&D spillovers have a positive impact on TFP, though the former is larger. Separating the sample into high and low R&D-intensity industries, our results indicate that North-South R&D spillovers raise TFP mainly in the R&D-intensive industries and South-South R&D spillovers raise TFP mainly in the low R&D-intensity industries. Thus, R&D-intensive industries learn mainly from trading with the North and low R&D-intensity industries learn mainly from trading within the South.

The findings are consistent with a situation of comparative advantage by the North in R&D-intensive industries, and with the comparative advantage in the different low R&D-intensity industries in the South varying by country. These results have implications for dynamic comparative advantage and for the dynamics of RIAs: North-South RIAs will tend to favor the development of R&D-intensive industries while South-South RIAs will tend to favor the development of low-R&D-intensity industries and are likely to retard the economic transformation of member countries to a high-R&D economy by reducing technology spillovers from the North.

TRADE-RELATED TECHNOLOGY DIFFUSION AND THE DYNAMICS OF NORTH-SOUTH AND SOUTH-SOUTH INTEGRATION

1. Introduction

Until the mid-1980s, growth theory assumed that economic growth and technical change were determined exogenously. According to this theory, policy affects the rate at which economies converge to the long-term (steady-state) growth rate but not the long-term rate itself. And the gains from trade that are obtained on the basis of exogenous growth theory are typically small. Growth theory underwent a fundamental change in the mid-1980s with the development of endogenous growth theory, which originated with the papers of Romer (1986, 1990) and Lucas (1988). These papers posit that the returns to the accumulation of knowledge (Romer) and human capital (Lucas) do not diminish at the aggregate level because of positive spillover effects, and that policies can have a permanent impact on the rate of economic growth.[1]

While Lucas and Romer dealt with closed economies, Grossman and Helpman (1991) explored endogenous growth theory in an open economy setting. The basic idea is that goods embody technological know-how and therefore countries can acquire foreign knowledge through imports.[2] Coe and Helpman (1995) provide an empirical implementation of the open economy endogenous growth model. They construct an index of foreign R&D as the trade-weighted sum of trading partners' stocks of R&D. They find for a sample of developed countries that both domestic and foreign R&D have a

[1] An excellent review of the origins of endogenous growth is Romer (1994).

significant impact on TFP, and that the latter increases with the general degree of openness of the economy and with openness towards the larger R&D producing countries.

Coe, Helpman and Hoffmaister (1997) examine the same issue for developing countries. They find that developing countries benefit more from foreign R&D spillovers, the more open they are and the more skilled is their labor force. These findings provide support for the hypothesis that trade is an important mechanism through which knowledge and technological progress is transmitted across countries.[3] Consequently, endogenous growth models generate larger gains from trade than exogenous growth ones.

This paper contributes to the literature on trade-related technology spillovers in several ways. First, it extends the developing country aggregate analysis of Coe et al. (1997) by examining these issues at the industry level. Keller (2002) provides an industry-level analysis for the G-7 and Sweden, but as far as we know, this paper provides the first analysis of trade-related technology spillovers at the industry level for developing countries.

Second, previous studies used R&D stocks from the OECD to construct trade-weighted foreign R&D stocks; we refer to these as "North-foreign R&D stocks." In addition, we construct an R&D stock which measures the 'indirect' technology spillovers

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[2] International diffusion of foreign knowledge can in principle occur through other channels than trade, including FDI, licensing, scientific journals, the internet, and other sources of cross-border communication.
[3] Keller (1998) constructs indices of foreign R&D with weights *not* related to trade, and obtains results that are as good or better than those of Coe and Helpman (1995), leading to doubts as to whether trade is in fact a main channel of technology diffusion. Lumenga-Neso, Olarreaga and Schiff (2000) use a trade-weighted index of foreign R&D by incorporating the effect of 'indirect' R&D. Simply put, it implies that countries learn not from the *produced* R&D stock of their trading partners but from their larger *available* R&D

arising from trade among developing countries. This is referred to as the "South-foreign R&D stock" (and is defined in Section 2).

Third, using industry-level data enables us to examine the impact of sectoral characteristics on international technology diffusion and TFP. One characteristic that is examined and which turns out to be important is R&D intensity.

The main findings for TFP in the South are:

1. TFP rises with North-foreign R&D (and thus with openness to the North).
2. TFP rises with South-foreign R&D (and thus with openness to the South), but the elasticity is smaller than with respect to North-foreign R&D.
3. The elasticity of TFP with respect to North-foreign R&D is at least twice as large for R&D-intensive industries than for low R&D-intensity industries.
4. The elasticity of TFP with respect to South-foreign R&D is positive for low R&D-intensity industries but is not significantly different from zero for R&D-intensive industries

Findings 3 and 4 imply that R&D-intensive industries learn mainly from the North and low R&D-intensity industries learn mainly from the South. These results have implications for dynamic comparative advantage and the dynamics of regional integration.

The remainder of the paper is organized as follows. Section 2 sets forth the empirical implementation, Section 3 describes the data, and Section 4 presents the results. Section 5 concludes.

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stocks. They obtain significantly better results than Coe and Helpman (1995) and marginally better ones

2. Empirical Implementation

The empirical analysis in Coe and Helpman (1995) builds on Grossman and Helpman's (1991) theoretical work on endogenous growth in the open economy. The estimated equation they derive is:

$$\log TFP_{ct} = \alpha_c + \alpha_t + \beta_d \log RD^d_{ct} + \beta_f \log RD^f_{ct} + \varepsilon_{ct}; \beta_d, \beta_f > 0, \qquad (1)$$

where α_c (α_t) is a country (time) fixed effect, RD^d_{ct} (RD^f_{ct}) is the domestic (foreign) R&D stock, ε is an error term, and c (t) denotes country (year).[4] Due to lack of data for developing countries--and as in Coe et al. (1997)--the equations estimated in this paper do not include domestic R&D. This is unlikely to have a significant impact on our results because most of the world's R&D is performed in developed countries.[5]

We estimate TFP equations both for each industry separately and with pooled data. We include two types of foreign R&D stocks, North-foreign R&D and South-foreign R&D. North-foreign R&D in industry i of developing country c, NRD_{ci}, is defined as:

$$NRD_{ci} \equiv \sum_j a_{cij} RD_{cj} = \sum_j a_{cij} \left[\sum_k \left(\frac{M_{cjk}}{VA_{cj}} \right) RD_{jk} \right], \qquad (2)$$

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than Keller (1998).

[4] The derivation is also provided in Keller (1998).

[5] In 1990, 96% of the world's R&D expenditures took place in industrial countries (Coe et al., 1997). Moreover, recent empirical work has shown that much of the technical change in OECD countries is based on the international diffusion of technology among OECD countries (Eaton and Kortum, 1999). For instance, Eaton and Kortum (1999) estimate that 87% of French growth is based on foreign R&D. Since developing countries invest much fewer resources in R&D than OECD countries, foreign R&D must be even more important for developing countries as a source of growth.

where c (k) indexes developing (OECD) countries, j indexes industries, M (VA) (RD) denotes imports (value added) (R&D), and a_{cij} is the import input-output coefficient (which measures for country c the share of imports of industry j that is sold to industry i).

The first part of equation (2) says that, in developing country c, North-foreign R&D in industry i, NRD_{ci}, is the sum, over all industries j, of RD_{cj}, the industry-j foreign R&D obtained through imports, multiplied by a_{cij}, the share of imports of industry j that is sold to industry i. Because data on *import* input-output flows are not available, they are proxied by *domestic* input-output flows in the estimation. The second part of equation (2) says that RD_{cj} is the sum, over OECD countries k, of M_{cjk}/VA_{cj}, the imports of industry-j products from OECD country k per unit of industry-j value added (i.e., the bilateral openness share), multiplied by RD_{jk}, the stock of industry-j R&D in OECD country k.

Note that this specification enables us to separate imports of intermediate and capital goods from imports of final consumer goods. Equation (2) includes the sales of imports to all the manufacturing sector industries but not sales of imports for final consumption. In other words, in equation (2), $\sum_j a_{cij} < 1$.

Since we have no data on domestic R&D in developing countries, and since most R&D in developing countries is imported from the developed countries, we construct a measure of 'indirect' South-foreign R&D. This concept is based on the idea that developing countries obtain knowledge from the North, absorb and assimilate it, transform it to fit their own needs, and incorporate it into their production process, and

that this transformed knowledge diffuses across the South through trade. South-foreign R&D, SRD_{ci}, captures this 'indirect' learning effect. That effect is given by

$$SRD_{ci} \equiv \sum_j a_{cij} \left[\sum_n \left(\frac{M_{cjn}}{VA_{cj}} \right) NRD_{jn} \right], \quad (3)$$

where M_{cjn} are industry-j imports by developing country c from developing country n.[6]

We also examine how the impact of NRD and SRD vary with industries' R&D intensity. The sixteen industries are clustered into two R&D-intensity groups, with a large gap between the high and low groups and relatively small differences within each group. We use a dummy variable to capture the differential effects associated with the two R&D-intensity groups. The two groups—and their R&D intensity--are shown in Section 3. Finally, as in Coe et al. (1997), we also include an education variable. The estimated equation is:

$$\begin{aligned} \log TFP_{cit} &= \beta_0 + (\beta_N + \gamma_N DR) \log NRD_{cit} + (\beta_S + \gamma_S DR) \log SRD_{cit} + \beta_E E_{ct} \\ &+ \sum_t \beta_t D_t + \sum_c \beta_c D_c + \sum_i \beta_i D_i + \varepsilon_{cit}; \beta_N, \beta_S, \beta_E > 0, \end{aligned} \quad (4)$$

where E denotes education and $D_t(D_c)(D_i)$ represents time (country) (industry) dummies, and DR = 1 (0) for high (low) R&D-intensity industries. Equation (4) was also estimated for each industry individually, in which case industry and R&D dummies are not included.

[6] On the concept of 'indirect' trade-related R&D spillovers, see footnote 3.

3. Definition of Variables and Data Sources

Our sample consists of 16 manufacturing industries in 25 developing countries over the period 1976-98.[7] The data series are briefly described here, with data provided in the appendix for some of the variables.[8]

The R&D intensity of the 16 industries is based on US data. An industry's R&D intensity was calculated as R&D expenditures divided by the value added of that industry. Figure 1 shows the R&D intensity of the 16 industries. As is immediately apparent, industries are clustered into two groups according to their R&D intensity. The average R&D-intensity of the "high" group is 11% while that of the "low" group is 1.3% (the respective standard deviations are 3.6% and .9%). Thus, the "high" cluster is on average more than 8 times more R&D intensive than the "low" cluster. [9]

The R&D flow data are taken from the ANBERD 2000 (OECD) database (DSTI/EAS Division). The database covers 15 OECD countries from 1973 to 1998 at either the two-, three- or four-digit level.[10] From this, we construct R&D flow data for 16

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[7] The 25 developing countries are: Bangladesh, Bolivia, Chile, Cameroon, Colombia, Cyprus, Ecuador, Egypt Arab Rep., Guatemala, Hong Kong- China, Indonesia, India, Iran Islamic Rep., Jordan, Korea Rep., Kuwait, Mexico, Malawi, Malaysia, Pakistan, Panama, Philippines, Poland, Trinidad and Tobago, Venezuela.

[8] The 16 industries consist of two groups of high and low R&D-intensity industries. The ten low R&D-intensity industries are: 31-Food, Beverage & Tobacco; 32-Textiles, Apparel & Leather; 33-Wood Products & Furniture; 34-Paper, Paper Products & Printing; 355/6-Rubber & Plastic Products; 36-Non-Metallic Mineral Products; 371-Iron & Steel; 372-Non-Ferrous Metals; 381-Metal Products; and 39-Other Manufacturing. The six R&D-intensive industries are: 351/2-Chemicals, Drugs & Medicines; 353/4-Petroleum Refineries & Products; 382-Non-Electrical Machinery, Office & Computing Machinery; 383-Electrical Machinery and Communication Equipment; 384-Transportation Equipment; and 385-Professional Goods.

[9] Note that for the "high" group, the average R&D-intensity *minus* two standard deviations is 3.8%, which is more than the average *plus* two standard deviations of the "low" group or 3.1%. Assuming a normal distribution, the hypothesis that any of the industries in the "high" R&D intensity cluster belongs to the "low" cluster is rejected at the 1% significance level..

[10] The 15 OECD countries are: Australia, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, Spain, Sweden, United Kingdom, and United States.

manufacturing industries at the two- or three-digit level (according to the United Nations International Standard Industrial Classification (ISIC) Revision 2). R&D flows cover all intramural business enterprise expenditures. R&D flows in domestic currency were deflated by respective GDP deflators (with 1990 GDP deflator = 100) and were converted in US dollars using 1990 nominal exchange rates. Cumulative R&D stocks are derived from these R&D flows using the perpetual inventory method with a 10% depreciation rate.

The input-output matrices for the twenty five developing countries are derived from GTAP (1998). Bilateral openness shares are from the World Bank database "Trade and Production 1976-1998" (Nicita and Olarreaga, 2001). For each country, industry and year, the shares are measured as the ratio of industry imports over value added. Trade data were collected at the 4-digit level and input-output data at the 3-digit level for the period 1976-98, and both were aggregated to 2- and 3-digit levels for consistency with the R&D data (16 industries). Average bilateral openness shares with the North are provided in Table A.2 and with the South in Table A.3. The matrix of bilateral trade shares is of dimension (25*16*23*(25+15))*16.

The TFP index is calculated in logs as the difference between output and factor use, with the inputs weighted by their income shares, i.e., $\log TFP = \log Y - \alpha \log L - (1-\alpha) \log K$, with α equal to labor's share. The capital stocks are derived from investment series using the perpetual inventory model with a 5% depreciation rate. The labor share is equal to the wage bill divided by the value of output. TFP data are derived from Nicita and Olarreaga (2001) and are in current dollars. These

were deflated by the US GDP deflator (1990 = 100). The TFP values averaged over all industries are provided in Table A.1.

The measure of education used is the share of the population aged twenty five and above that completed secondary education. This is taken from Barro-Lee (2000) which provides five-year averages for 1960-2000. These data were annualized by interpolation and are shown in Table A.4.[11] This measure was preferred to enrollment variables because we are interested in stock rather than flow variables. The values for 1998 are shown in Table A.5.

4. Estimation Results

4.1. Pooled Data

Table 1 reports the estimation results with the pooled data for four alternative specifications. The explanatory variables are foreign R&D, education and governance. North-foreign R&D (NRD) is used in specification (i)—which is equation (4) with $\gamma_N = \beta_S = \gamma_S = 0$. NRD and its interaction with the high-R&D intensity dummy (DR) are used in specification (ii)—i.e., equation (4) with $\beta_S = \gamma_S = 0$. NRD and SRD (South-foreign R&D) are used in specification (iii), i.e., equation (4) with $\gamma_N = \gamma_S = 0$. Finally, NRD, SRD and their interaction with DR are used in specification (iv). The education and governance variables are used in the four specifications. The t-statistics are given in

[11] This seems reasonable since the annual volatility of the share of the population that completed secondary education is very small.

parenthesis. We first describe the results dealing with foreign R&D, and then describe those for education and governance.

Column (i) shows an elasticity of TFP with respect to North-foreign R&D of about 0.19, significant at the 1% level. Thus, a 10% increase in openness—say, from 20% to 22%, distributed uniformly across all trading partners in the North, raises TFP by 1.9%. Thus, simply opening up the economy to the North leads to a higher TFP and a higher income.

In column (ii), we examine whether there is an added effect for R&D-intensive industries. We find that the elasticity of TFP with respect to low R&D-intensity industries is .138 and that it is twice as large (.138 + .141 = .279) for R&D-intensive industries, with both significant at the 1% level. A 10% increase in openness to the North distributed uniformly across all industries raises TFP of low R&D intensity industries by about 1.4% and TFP in high R&D-intensive industries by almost 2.8%. One interpretation of this result is that the technology gap between the North and the South is larger for R&D-intensive industries, and that--by trading with the North--the South experiences a greater "catch-up" effect in those industries.

In column (iii), we add the effect of South-foreign R&D to the variables in column (i). The elasticity is also positive (.068) and significant at the 5% level, but it is significantly smaller than the elasticity of .125 with respect to North-foreign R&D.[12] Thus, the South learns more from trading with the North than from trading with the South.

In column (iv), the interaction effects with the dummy variable for R&D-intensive industries are included. We find that the elasticity of TFP with respect to North-foreign R&D is positive (.063) for low R&D-intensity industries but not significant, and that the elasticity is positive (.273) and significant at the 1% level for R&D-intensive industries. Interestingly, the opposite holds for South-foreign R&D: the effect is positive (.084) and significant for low R&D-intensity industries, and it is positive, small (.01) and not significantly different from zero for R&D-intensive industries.

These results indicate that, in developing countries, R&D-intensive industries learn essentially from trading with the North and low R&D-intensity industries learn essentially from trading within the South, with the former about three times as large as the latter. These results can be explained with the theory of comparative advantage, and have implications for dynamic comparative advantage and for the dynamics of regional integration agreements (RIAs).

Given that the North has a comparative advantage in R&D-intensive industries--and the South has a comparative advantage in low R&D-intensity industries--the South would be expected to absorb more knowledge in the R&D-intensive industries from its trade with the North. Within the South, industries with comparative advantage among low R&D-intensive industries differ by country. For instance, the industry with the highest (period average) TFP value is Textiles, Apparel and Leather in Bangladesh, India and Mexico; Wood Products and Furniture in Iran and Trinidad and Tobago; Non-Metallic Mineral Products in Jordan; Iron & Steel in Egypt; Non-Ferrous Metals in

[12] Testing for equality of coefficients, the F-value obtained is 20.81 while the critical value at 5% is $F_{2,5746}$ =

Pakistan; and Metal Products in Colombia, Ecuador, Indonesia and Kuwait. Thus, countries in the South are likely to learn mainly from trading with each other in low R&D-intensive products.

The North-South and South-South technology diffusion and learning process will affect productivity and the degree of comparative advantage over time. An early model of trade, technical change and dynamic comparative advantage is Krugman (1987). The issue has also been examined by Grossman and Helpman (1990, 1991). Redding (1999) argues that a trade-off exists for developing countries between low-technology sectors with existing comparative advantage and high-technology sectors where a comparative advantage may be acquired as a result of productivity growth based on learning by doing.

In this paper, productivity change is based on international technology diffusion and can be affected by trade policy. A uniform MFN tariff reduction raises TFP in all industries, though more so in the R&D-intensive ones. A North-South RIA increases trade flows among member countries and reduces it with excluded countries. This raises TFP in R&D-intensive industries and reduces it in low R&D-intensity industries, with the former being larger than the latter. On the other hand, a South-South RIA raises TFP in low R&D-intensity industries and lowers it in R&D-intensive industries. Thus, South-South RIAs are likely to retard the transformation of the economy of member countries to a high-R&D, high-tech economy by reducing the technology spillovers in those sectors from the North.

3.0, and P = 0.

Turning to education, its effect on TFP is positive and significant at the 1% level, and the coefficient is robust across the four specifications in Table 1 (about 6.8). The coefficient implies that, if the share of the population of age 25 and above that completed a high-school education increases by 1 percentage point, TFP will rise by about 6.8%. Education levels for 1998 are shown in Table A.5. The cross-country average education level is 13.3%. Thus, a 1 percentage point increase in education is equal to an average increase of about 7.6%, implying an average elasticity of about .9.

4.2. Estimation Results by Industry

The results of estimating equation (4) are shown in Tables 2 and 3. In Table 2, we assume $\beta_S = 0$. Table 2 shows that the effect of North-foreign R&D is positive in 14 of 16 industries. The effect is significant in 5 of the 6 R&D-intensive industries (83%) and in 4 of the 10 low R&D-intensity industries (40%). The stronger result for R&D-intensive industries confirms the result obtained with pooled data. The effect of education on TFP is positive for all industries and significantly so in 10 of them. Table 3 includes South-foreign R&D. Its effect is positive in 10 industries. It is significantly positive in 2 out of 6 R&D-intensive industries (33%) and in 5 out of 10 low R&D-intensity industries (50%). This also seems to confirm the result of the pooled regression of a greater effect of South-foreign R&D on TFP for low R&D-intensity industries.

5. Conclusion

Recent theoretical models of economic growth have highlighted the importance of trade as a channel of technology diffusion. Empirical studies of North-South trade-related technology diffusion and its impact on total factor productivity (TFP) have been undertaken at the aggregate level. This paper is, as far as we know, the first to examine North-South—as well as South-South--trade-related technology diffusion at the industry level. It also examines the impact of education and governance on TFP.

We find that North-South and South-South R&D spillovers have a positive impact on TFP, though the former is larger. Separating the sample into high and low R&D-intensity industries, we find that North-South R&D spillovers raise TFP mainly in the R&D-intensive industries and South-South R&D spillovers raise TFP mainly in the low R&D-intensity industries. Thus, R&D-intensive industries learn mainly from trading with the North and low R&D-intensity industries learn mainly from trading within the South.

The findings with respect to R&D are consistent with a situation of comparative advantage by the North in R&D-intensive industries, and with the comparative advantage in the different low R&D-intensity industries in the South varying by country. These results have implications for dynamic comparative advantage and for the dynamics of RIAs: North-South RIAs will tend to favor the development of R&D-intensive industries while South-South RIAs will tend to favor the development of low-R&D-intensity industries and are likely to retard the economic transformation of member countries to a high-R&D economy by reducing technology spillovers from the North.

Figure 1. R&D Intensity Across Industries

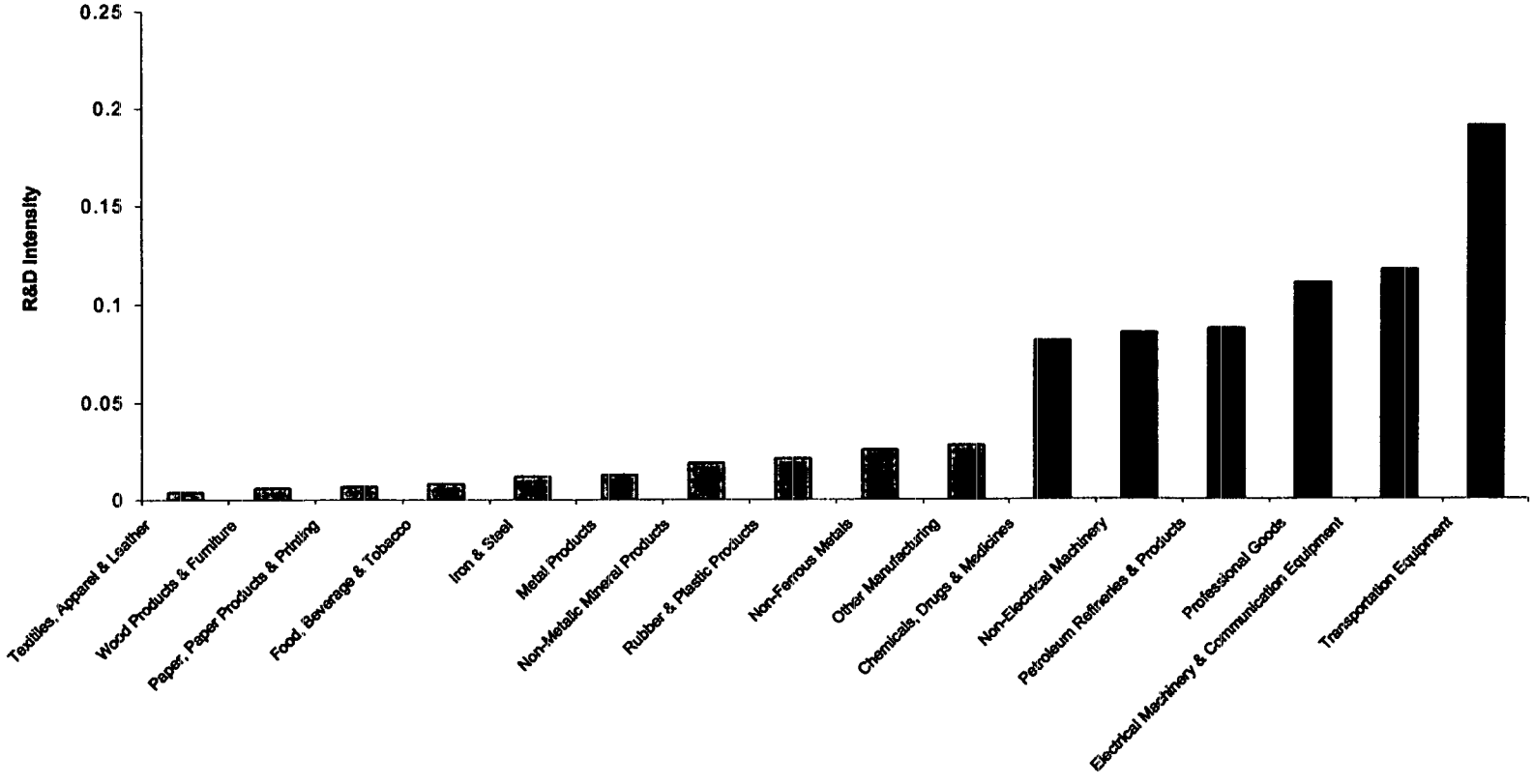

Table 1. Determinants of log TFP
(Pooled Regression Results)

Variables	(i)	(ii)	(iii)	(iv)
logNRD	**0.188** *(6.11)****	**0.138** *(4.03)****	**0.125** *(2.98)****	**0.063** *(1.37)*
logNRD*DR		**0.141** *(3.52)****		**0.210** *(3.63)****
logSRD			**0.068** *(2.12)***	**0.084** *(2.35)***
logSRD*DR				**-0.074** *(-1.87)**
E	**6.831** *(4.34)****	**6.823** *(4.34)****	**6.750** *(4.28)****	**6.783** *(4.31)****
Adjusted R^2	**0.23**	**0.232**	**0.23**	**0.232**
No. of Observations	**5759**	**5759**	**5756**	**5756**

Note: Figures in parentheses are t-statistics. Significance levels of 1%, 5% and 10% are indicated by ***, ** and * respectively. Regression results on country, year and industry dummies, and the constant, are not reported. NRD is the trade-related North-foreign R&D, SRD is the trade-related South-foreign R&D, and DR = 1 for R&D-intensive industries and DR= 0 for low R&D-intensity industries. E is the secondary school completion ratio for the population aged 25+.

Table 2. Determinants of log TFP (Single Industry Regression Results; Specification (i))

Var.\ISIC	32	33	34	31	371	381	36	355/6	372	39	351/2	353/4	382	385	383	384
logNRD	0.10	0.16	0.01	0.11	2.02	0.21	0.17	-0.04	1.36	-0.01	0.36	0.44	0.45	0.06	0.12	0.98
	(1.29)	*(1.62)*	*(0.12)*	*(0.80)*	*(2.25)* **	*(4.28)* ***	*(3.39)* ***	*(-0.16)*	*(3.59)* ***	*(-0.09)*	*(3.39)* ***	*(4.46)* ***	*(4.56)* ***	*(0.65)*	*(1.62)*	*(5.08)* ***
E	10..85	6.18	5.91	7.72	7.30	6.28	8.10	7.52	5.91	8.62	3.73	0.74	14.40	13.68	5.12	1.87
	(4.44) ***	*(3.11)* ***	*(2.19)* **	*(2.13)* **	*(0.38)*	*(3.87)* ***	*(4.47)* ***	*(0.95)*	*(0.65)*	*(2.61)* **	*(1.09)*	*(0.31)*	*(4.71)* ***	*(4.67)* ***	*(2.06)* **	*(0.28)*
Adj. R2	*0.63*	*0.70*	*0.62*	*0.34*	*0.20*	*0.81*	*0.75*	*0.15*	*0.20*	*0.50*	*0.52*	*0.73*	*0.64*	*0.48*	*0.52*	*0.41*
Obs.	404	388	390	404	286	386	388	359	301	362	387	299	342	283	390	390

Note: Figures in parentheses are t-statistics. Significance levels of 1%, 5% and 10% are indicated by ***, ** and * respectively. Regression results on country and year dummies, and the constant, are not reported. NRD is the trade-related North-foreign R&D. E is the secondary school completion ratio for the population aged 25+. ISIC codes represent the following industries: (1) 31-Food, Beverage & Tobacco; (2) 32- Textiles, Apparel & Leather; (3) 33-Wood Products & Furniture; (4) 34- Paper, Paper Products & Printing; (5) 351/2- Chemicals, Drugs & Medicines; (6) 353/4- Petroleum Refineries & Products; (7) 355/6- Rubber & Plastic Products; (8) 36- Non-Metallic Mineral Products; (9) 371- Iron & Steel; (10) 372- Non-Ferrous Metals; (11) 381- Metal Products; (12) 382- Non-Electrical Machinery, Office & Computing Machinery; (13) 383- Electrical Machinery and Communication Equipment; (14) 384- Transportation Equipment; (15) 385- Professional Goods; and (16) 39- Other Manufacturing.

Table 3. Determinants of log TFP (Single Industry Regression Results; Specification (iii))

Var.\ISIC	32	33	34	31	371	381	36	372	39	351/2	353/4	355/6	382	385	383	384
logNRD	**-0.09**	**0**	**-0.12**	**0.11**	**2.61**	**0.12**	**0.08**	**1.59**	**-0.3**	**0.56**	**0.47**	**-0.23**	**0.42**	**-0.38**	**-0.28**	**1.12**
	(-0.93)	*(0.02)*	*(-0.95)*	*(0.69)*	*(2.29)* **	*(1.90)* *	*(1.17)*	*(3.39)* ***	*(-1.71)* *	*(3.73)* ***	*(4.27)* ***	*(-0.66)*	*(2.39)* **	*(-2.12)* **	*(-2.21)* **	*(4.52)* ***
logSRD	**0.22**	**0.16**	**0.1**	**0**	**-0.39**	**0.09**	**0.08**	**-0.14**	**0.23**	**-0.16**	**-0.02**	**0.16**	**0.02**	**0.26**	**0.26**	**-0.12**
	(3.07) ***	*(3.60)* ***	*(1.31)*	*(-0.01)*	*(-0.85)*	*(2.17)* **	*(2.70)* **	*(-0.65)*	*(2.5)* **	*(-1.86)* *	*(-0.43)*	*-0.76*	*-0.2*	*(2.91)* ***	*(3.88)* ***	*(-0.88)*
E	**11.15**	**6.13**	**5.72**	**7.71**	**7.43**	**6.11**	**7.94**	**7.32**	**8.02**	**4**	**0.69**	**7.64**	**14.41**	**13.34**	**4.26**	**1.61**
	(4.62) *	*(2.63)* **	*(2.11)* **	*(2.13)* **	*(0.39)*	*(3.79)* *	*(4.41)* *	*(0.8)*	*(2.42)* **	*(1.17)*	*(0.3)*	*(0.97)*	*(4.7)* *	*(4.63)* ***	*(1.74)* *	*(0.24)*
Adj. R2	**0.65**	**0.7**	**0.62**	**0.34**	**0.2**	**0.81**	**0.76**	**0.2**	**0.51**	**0.52**	**0.75**	**0.14**	**0.64**	**0.49**	**0.54**	**0.41**
Obs.	**404**	**388**	**390**	**404**	**286**	**386**	**388**	**300**	**362**	**387**	**298**	**359**	**341**	**283**	**390**	**390**

Note: Figures in parentheses are t-statistics. Significance levels of 1%, 5% and 10% are indicated by ***, ** and * respectively. Regression results on country, year and industry dummies, and the constant, are not reported. NRD is the trade-related North-foreign R&D, SRD is the trade-related South-foreign R&D. E is the secondary school completion ratio for the population aged 25+. Voice, Political Instability, Government Effectiveness, Burden, Rule of Law, and Graft are governance indicators. ISIC codes represent the following industries: (1) 31-Food, Beverage & Tobacco; (2) 32- Textiles, Apparel & Leather; (3) 33-Wood Products & Furniture; (4) 34- Paper, Paper Products & Printing; (5) 351/2- Chemicals, Drugs & Medicines; (6) 353/4- Petroleum Refineries & Products; (7) 355/6- Rubber & Plastic Products; (8) 36- Non-Metallic Mineral Products; (9) 371- Iron & Steel; (10) 372- Non-Ferrous Metals; (11) 381- Metal Products; (12) 382- Non-Electrical Machinery, Office & Computing Machinery; (13) 383- Electrical Machinery and Communication Equipment; (14) 384- Transportation Equipment; (15) 385- Professional Goods; and (16) 39- Other Manufacturing.

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Appendix

Table A.1: Average TFP over 1976-1998[1]

Country\Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Bangladesh		3.61	3.56	3.58	3.61	3.43	3.08	2.63	2.57	2.56	2.46	2.44	2.18	2.81	2.69	2.88	2.97						
Bolivia		3.20	2.43	2.78	2.76	2.22	1.29	3.02	4.87	0.71	1.24	2.35	1.10	0.93	0.93	0.96	0.98	1.08	1.16	1.01	1.05	1.12	1.14
Chile						4.22	3.64	3.06	2.86	2.52	2.50	2.51	2.53	2.55	2.68	2.76	2.83	2.80	2.93	2.92	2.91	2.92	2.80
Cameroon	4.80	4.69	4.73	4.95	4.64	4.45	4.20	4.17	3.95	6.25	5.24								7.20	7.02			
Colombia			3.08	2.92	2.80	2.68	2.52	2.46	2.30	2.03	1.78	1.78	1.62	1.58	1.44	1.38	1.70	1.98	2.06	2.08	2.12	2.27	2.20
Cyprus	3.36	3.50	3.59	3.88	4.00	4.34	4.51	4.51	4.46	4.41	4.54	4.56	4.50	4.39	4.66	4.64	4.84	4.85	5.04	5.86	5.02	4.84	4.90
Ecuador					4.19	4.45	4.91	3.57	3.66	3.62	3.17	2.87	2.34	2.53	2.77	2.51	3.05	2.93	1.02	1.10	0.88	0.47	
Egypt						5.34	16.12	5.01	6.88	7.95	5.61	5.15	3.75	3.73									
Guatemala						2.92	3.06	2.92	2.95	2.93	2.32	1.90	2.21										
Hong Kong						4.81	4.75	4.44	5.25	5.40	5.19	5.00	4.95	4.86	4.95	4.91	4.52	4.92	5.02	4.81	4.88	4.85	4.88
Indonesia						2.25	2.09	1.85	1.55	1.38	1.19	0.91	0.95	0.85	0.32	0.41	0.56	0.64	0.66	1.37	1.28	0.36	
India					4.14	3.64	3.82	3.38	3.42	3.30	3.41	3.30	2.93	2.68	2.50	2.19	2.31	1.85	1.80	1.84	1.83	1.89	1.92
Iran						6.35	6.00	5.90	5.63	5.12	5.36	4.62	4.27	4.01									
Jordan						2.30	2.28	2.44	2.90	3.04	2.55	2.34	2.03	1.38	0.56	1.02	1.22	1.21	1.23	1.56	2.42	1.78	
Korea, Rep.	3.01	3.01	3.09	3.26	2.90	2.65	2.60	2.45	2.48	2.44	2.33	2.51	2.74	3.02	2.74	2.52	2.45	2.47	2.38	2.37	2.53	2.19	
Kuwait						4.34	5.07	5.18	5.78	5.63	4.94	4.92	4.85	4.55	5.13	4.73	4.31	4.00	3.84	3.76	4.07	3.49	
Mexico						3.67	3.32	2.09	2.89	2.72	2.36	2.07	2.24	2.41	2.54	2.72	2.96	2.97	2.82	1.96	2.10	2.31	2.35
Malawi				4.13	4.05	4.47	4.07	3.07	2.84	3.13	2.86	2.38	1.76	2.58	3.34	2.83	1.69						
Malaysia			3.46	3.25	3.29	3.34	3.45	3.20	3.20	3.19	2.94	2.85	2.60	2.34	2.32	2.24	2.34	2.32	2.30	2.43	2.34	2.33	1.99
Pakistan							2.19	2.09	1.97	1.99	2.36	2.35	2.16	2.08	2.13	2.18	2.13						
Panama											3.71						3.48	4.70	4.13		4.54	4.76	
Philippines		3.76	3.32	2.55	2.41	2.61	3.11	2.14	1.75	2.51	2.72	2.32	2.47	2.48	2.40	2.32	2.43	1.96	2.14	2.08	2.14	2.06	
Poland					2.00	4.13	1.51	1.82	1.63	1.42	1.34	0.95	1.12	1.02	0.57	1.72	2.16	2.23	2.39	2.67	2.84	2.96	3.07
Trinidad						5.40	5.61	5.64	6.26	5.97	5.40	5.18	6.09	3.58	3.61	3.51	4.00	2.92	3.09	2.50			
Venezuela						4.36	4.13	4.10	3.29	3.46	3.35	2.68	2.74	2.10	2.03	2.03	2.01	2.26	1.47	1.63	0.87		

[1] Figures are averages for each year of the available industries in each country.

Table A.2: Bilateral Openness Shares with the North[1], by Industry (average over OECD countries and time)

Country\ISIC	31	32	33	34	351/2	353/4	355/6	36	371	372	381	382	383	384	385	39
Bangladesh	*0.29*	*0.09*	*0.12*	*0.40*	*0.59*	*1.04*	*2.06*	*0.26*	*1.77*	*29.69*	*2.66*	*10.72*	*1.85*	*3.68*	*157.95*	*0.13*
Bolivia	*0.14*	*0.21*	*0.13*	*0.79*	*2.23*	*5.46*	*0.93*	*0.12*	*25.26*	*0.08*	*2.36*	*123.72*	*21.48*	*63.02*	*13.48*	*4.16*
Chile	*0.03*	*0.16*	*0.04*	*0.09*	*0.56*	*0.08*	*0.36*	*0.11*	*0.25*	*0.01*	*0.48*	*4.77*	*2.89*	*2.87*	*9.31*	*2.00*
Cameroon	*0.18*	*0.32*	*0.11*	*1.88*	*2.92*	*0.00*	*0.63*	*0.88*	*0.96*	*0.24*	*3.63*	*3.82*	*7.84*	*86.92*	*0.00*	*0.40*
Colombia	*0.05*	*0.06*	*0.09*	*0.27*	*0.67*	*0.18*	*0.14*	*0.07*	*0.78*	*0.72*	*0.39*	*4.80*	*1.66*	*1.82*	*2.37*	*0.18*
Cyprus	*1.08*	*0.82*	*0.27*	*1.35*	*4.93*	*5.63*	*1.38*	*0.57*	*0.00*	*0.00*	*1.44*	*7.84*	*13.94*	*28.56*	*78.98*	*1.63*
Ecuador	*0.09*	*0.16*	*0.05*	*0.64*	*2.03*	*0.28*	*0.35*	*0.17*	*2.07*	*1.88*	*0.73*	*52.14*	*3.24*	*7.08*	*17.11*	*1.47*
Egypt	*0.60*	*0.08*	*3.03*	*0.59*	*0.79*	*0.20*	*0.66*	*0.19*	*2.95*	*0.35*	*0.90*	*3.90*	*1.32*	*1.44*	*7.10*	*1.83*
Guatemala	*0.07*	*0.11*	*0.09*	*0.22*	*0.54*	*1.90*	*0.10*	*0.05*	*0.72*	*3.59*	*0.44*	*7.55*	*0.94*	*6.02*	*4.99*	*0.35*
Hong Kong	*2.62*	*2.80*	*8.71*	*0.95*	*10.49*	*1.31*	*8.30*	*5.75*	*21.91*	*12.10*	*2.39*	*7.30*	*8.02*	*7.49*	*7.85*	*9.95*
Indonesia	*0.08*	*0.16*	*0.01*	*0.83*	*1.46*	*4.21*	*0.16*	*0.28*	*0.27*	*0.52*	*1.25*	*5.51*	*3.17*	*1.98*	*5.69*	*0.67*
India	*0.11*	*0.03*	*0.05*	*0.28*	*0.35*	*0.07*	*0.07*	*0.05*	*0.27*	*0.58*	*0.69*	*0.69*	*0.31*	*0.27*	*1.42*	*1.32*
Iran	*0.16*	*0.04*	*0.06*	*0.04*	*0.47*	*1.73*	*0.14*	*0.02*	*0.56*	*0.26*	*0.23*	*1.02*	*0.52*	*0.72*	*2.32*	*0.12*
Jordan	*0.57*	*0.84*	*0.79*	*0.83*	*1.39*	*0.08*	*1.33*	*0.15*	*1.90*	*0.94*	*1.64*	*17.43*	*19.30*	*164.28*	*12.05*	*5.90*
Korea, Rep.	*0.17*	*0.20*	*0.09*	*0.28*	*0.85*	*0.20*	*0.07*	*0.13*	*0.49*	*1.04*	*0.71*	*1.88*	*0.67*	*0.54*	*2.07*	*0.25*
Kuwait	*1.37*	*1.60*	*1.12*	*0.74*	*1.79*	*0.02*	*1.37*	*0.47*	*11.60*	*0.00*	*1.45*	*16.20*	*8.01*	*52.86*	*5.85*	*2.48*
Mexico	*0.25*	*1.68*	*2.86*	*1.33*	*0.81*	*4.00*	*1.63*	*0.20*	*0.49*	*0.61*	*1.75*	*7.12*	*3.99*	*0.93*	*9.01*	*2.85*
Malawi	*0.12*	*0.27*	*0.07*	*0.37*	*1.10*	*0.00*	*0.40*	*0.44*	*0.00*	*0.00*	*0.80*	*2.51*	*4.91*	*11.12*	*0.00*	*0.00*
Malaysia	*0.40*	*0.38*	*0.04*	*0.77*	*1.74*	*0.20*	*0.18*	*0.33*	*3.28*	*4.33*	*1.50*	*7.90*	*2.22*	*4.65*	*5.48*	*1.21*
Pakistan	*0.11*	*0.03*	*0.06*	*0.43*	*0.57*	*0.20*	*0.26*	*0.05*	*0.39*	*21.84*	*1.54*	*3.85*	*0.99*	*2.26*	*4.55*	*0.27*
Panama	*0.16*	*0.49*	*0.58*	*0.83*	*1.56*	*0.96*	*0.56*	*0.15*	*1.05*	*1.50*	*1.52*	*27.50*	*2.83*	*3.63*	*1.07*	*0.00*
Philippines	*0.15*	*0.17*	*0.05*	*0.56*	*1.00*	*0.11*	*0.30*	*0.20*	*1.50*	*2.14*	*1.42*	*10.76*	*1.76*	*2.88*	*8.66*	*0.50*
Poland	*0.18*	*0.27*	*0.06*	*0.46*	*0.58*	*0.07*	*0.31*	*0.15*	*0.20*	*0.36*	*0.25*	*0.57*	*0.49*	*0.31*	*1.01*	*0.45*
Trinidad & T.	*0.59*	*1.29*	*1.00*	*0.96*	*2.80*	*0.00*	*1.76*	*0.51*	*0.28*	*0.00*	*3.26*	*138.43*	*7.55*	*8.40*	*0.00*	*0.47*
Venezuela	*0.11*	*0.15*	*0.08*	*0.31*	*0.53*	*0.03*	*0.15*	*0.09*	*0.27*	*0.16*	*0.43*	*4.59*	*1.57*	*1.38*	*3.02*	*0.39*

[1] Share of total imports from the North over value added.

Table A.3: Bilateral Openness Shares with the South[1], by Industry (average over OECD countries and time)

Country\ISIC	31	32	33	34	351/2	353/4	355/6	36	371	372	381	382	383	384	385	39
Bangladesh	0.15	0.21	0.07	0.13	0.19	1.34	1.67	1.36	0.41	30.93	0.55	2.68	0.44	0.71	16.80	0.39
Bolivia	0.05	0.22	0.04	0.41	0.71	3.28	0.77	0.05	5.11	0.07	0.61	8.78	3.56	6.54	1.14	2.09
Chile	0.01	0.14	0.01	0.01	0.11	0.06	0.05	0.02	0.07	0.00	0.06	0.16	0.77	0.59	0.66	0.38
Cameroon	0.01	0.10	0.00	0.02	0.04	0.00	0.03	0.07	0.02	0.00	0.10	0.02	0.25	3.23	0.00	0.04
Colombia	0.04	0.03	0.05	0.06	0.14	0.42	0.05	0.02	0.30	1.50	0.08	0.25	0.19	0.40	0.16	0.06
Cyprus	0.05	0.33	0.02	0.03	0.12	0.17	0.16	0.01	0.00	0.00	0.05	0.23	1.51	0.50	8.96	0.25
Ecuador	0.06	0.10	0.02	0.28	0.67	0.20	0.19	0.13	1.34	1.08	0.19	3.53	0.72	1.21	3.37	0.63
Egypt	0.10	0.04	0.86	0.06	0.05	0.06	0.18	0.01	0.41	0.03	0.06	0.14	0.18	0.11	0.78	1.01
Guatemala	0.01	0.05	0.01	0.03	0.12	0.29	0.03	0.02	0.22	2.32	0.12	0.57	0.14	0.62	0.54	0.14
Hong Kong	0.56	1.00	4.21	0.23	3.26	0.46	0.80	0.95	5.28	3.84	0.33	0.95	2.07	0.61	0.97	2.01
Indonesia	0.08	0.13	0.00	0.06	0.22	2.37	0.04	0.06	0.09	0.23	0.13	0.51	0.26	0.04	0.23	0.29
India	0.14	0.02	0.04	0.03	0.09	0.14	0.01	0.02	0.04	0.23	0.02	0.04	0.04	0.01	0.09	0.22
Iran	0.01	0.06	0.00	0.00	0.03	0.16	0.01	0.00	0.02	0.04	0.04	0.06	0.02	0.06	0.07	0.02
Jordan	0.22	0.75	0.40	0.13	0.18	0.08	0.41	0.02	0.30	0.59	0.25	0.81	2.06	7.90	1.09	1.22
Korea, Rep.	0.03	0.02	0.14	0.02	0.02	0.07	0.00	0.00	0.01	0.24	0.00	0.01	0.03	0.09	0.03	0.02
Kuwait	0.32	1.16	0.58	0.12	0.11	0.00	0.35	0.09	1.45	0.00	0.18	0.36	0.84	3.16	0.46	1.12
Mexico	0.02	0.23	0.19	0.04	0.02	0.29	0.06	0.01	0.03	0.08	0.03	0.12	0.24	0.02	0.31	0.23
Malawi	0.02	0.32	0.01	0.00	0.05	0.00	0.14	0.09	0.00	0.00	0.11	0.05	0.13	0.22	0.00	0.00
Malaysia	0.12	0.46	0.03	0.14	0.20	0.12	0.04	0.05	0.61	0.83	0.22	0.51	0.31	0.21	0.50	0.42
Pakistan	0.17	0.02	0.15	0.07	0.11	1.63	0.12	0.02	0.02	4.15	0.13	0.15	0.18	0.05	0.71	0.13
Panama	0.05	0.41	0.35	0.16	0.73	0.52	0.33	0.11	1.71	0.82	0.63	2.34	0.64	1.04	0.10	0.00
Philippines	0.03	0.25	0.08	0.08	0.23	0.17	0.11	0.05	0.35	0.37	0.24	0.81	0.23	0.10	0.76	0.25
Poland	0.02	0.03	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.02	0.05	0.03	0.03	0.06
Trinidad & T.	0.02	0.42	0.05	0.12	0.10	0.00	0.24	0.17	0.05	0.00	0.15	4.03	0.29	0.54	0.00	0.07
Venezuela	0.02	0.22	0.06	0.08	0.08	0.00	0.04	0.02	0.04	0.03	0.04	0.16	0.19	0.06	0.30	0.16

[1] Share of total imports from the South over value added.

Table A.4: Secondary School Completion Ratio of the Population Aged 25+ by Country and by Year[1]

Country\Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Bangladesh	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Bolivia	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06
Chile	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Cameroon	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03
Colombia	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Cyprus	0.13	0.13	0.13	0.13	0.13	0.14	0.15	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.19	0.19	0.20	0.20
Ecuador	0.06	0.07	0.07	0.07	0.08	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.08	0.08
Egypt	0.03	0.03	0.04	0.04	0.04	0.05	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.10	0.10	0.10	0.11	0.12
Guatemala	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
Hong Kong	0.16	0.16	0.17	0.17	0.17	0.18	0.19	0.20	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.26	0.27	0.28	0.28	0.29	0.29	0.29	0.29
Indonesia	0.03	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.07	0.08	0.08	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.11
India	0.03	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Iran	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.13	0.13
Jordan	0.07	0.07	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.08	0.09	0.09	0.10	0.10	0.11	0.12	0.13	0.13	0.14	0.15	0.16	0.16
Korea, Rep.	0.15	0.16	0.17	0.18	0.19	0.20	0.22	0.23	0.24	0.26	0.28	0.30	0.32	0.33	0.35	0.35	0.36	0.36	0.36	0.36	0.36	0.35	0.35
Kuwait	0.11	0.13	0.13	0.14	0.15	0.16	0.17	0.18	0.18	0.19	0.20	0.20	0.21	0.21	0.22	0.22	0.23	0.24	0.24	0.25	0.25	0.25	0.25
Mexico	0.04	0.04	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.08	0.09	0.10	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.13	0.13
Malawi	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Malaysia	0.07	0.08	0.09	0.09	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.13	0.13	0.13	0.14	0.16	0.19	0.20	0.22	0.24	0.24	0.24	0.24
Pakistan	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.05	0.06	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Panama	0.10	0.10	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.13	0.14	0.14	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Philippines	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.13	0.14	0.14	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.17	0.17
Poland	0.11	0.12	0.12	0.13	0.13	0.14	0.14	0.14	0.14	0.15	0.16	0.17	0.17	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Trinidad	0.04	0.04	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.11	0.11	0.12	0.12	0.12
Venezuela	0.06	0.07	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04

1. This ratio is interpolated based on the Barro-Lee (2000).

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